THE INCIDENT AT THE SKIKDA PLANT:

DESCRIPTON AND PRELIMINARY CONCLUSIONS

LNG 14, Session 1

21 MARCH 2004

DOHA - QATAR

Bachir ACHOUR & Ali HACHED

DOWNSTREAM VICE PRESIDENT

MARKETING VICE PRESIDENT

SUMMARY

- ALGERIAN LNG INDUSTRY.
- THE SKIKDA LNG PLANT.
- THE 19 JANUARY 2004 INCIDENT.
- EXTENT OF DAMAGES .
- PRESENT STATUS.
- ACTIONS TAKEN BY SONATRACH.
- ALGERIAN LNG MARKETING

ALGERIAN LNG INDUSTRY

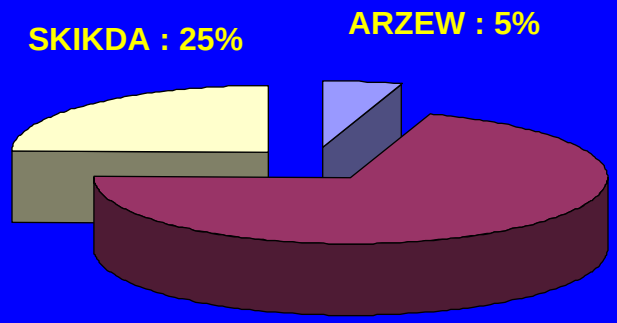
- ALGERIA IS AN LNG INDUSTRY PIONEER.
- ALGERIA : ONE OF THE MAIN LNG PRODUCERS.
- SONATRACH: LEADING COMPANY WITHIN LIQUEFACTION CAPACITY.

ALGERIAN LNG INDUSTRY

Arzew and Béthioua Industrial Area

Skikda Industrial Area

➔ LIQUEFACTION CAPACITY : 23 MMTPA

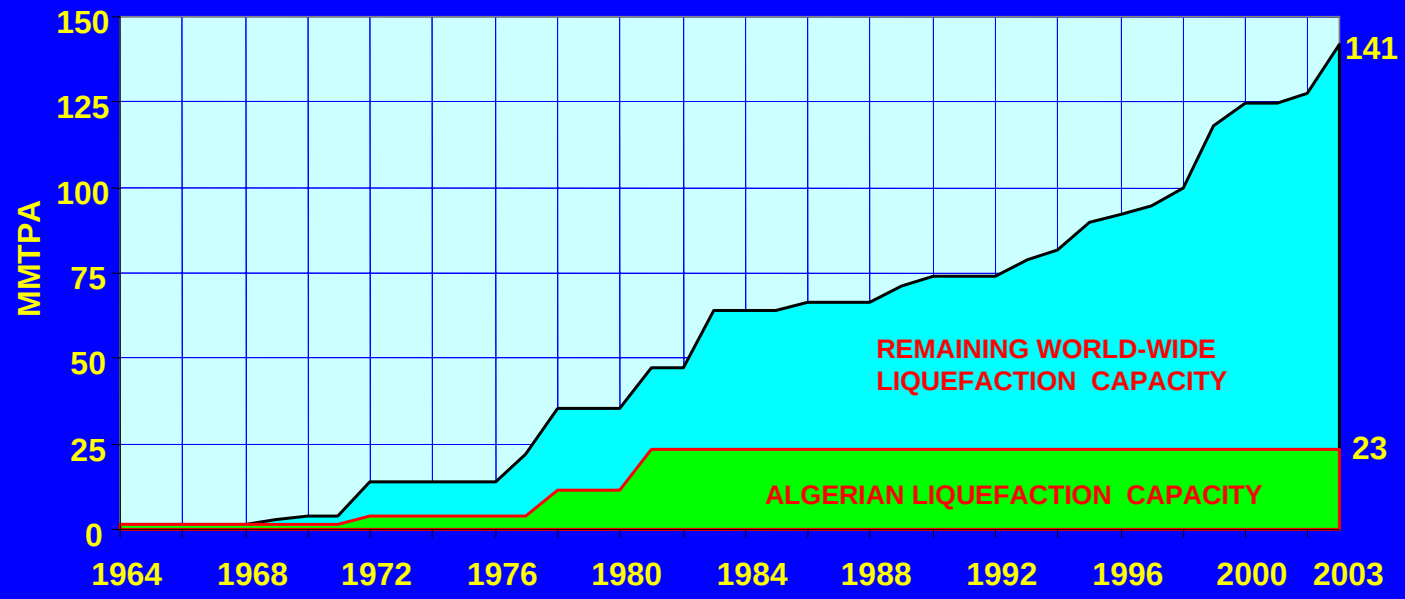


➔ 4 LNG PLANTS : 21 TRAINS.

- ➔ 1 LNG PLANT (3 TRAINS) AT ARZEW
- ➔ 2 LNG PLANTS (12 TRAINS) AT BETHIOUA
- ➔ 1 LNG PLANT (6 TRAINS) AT SKIKDA

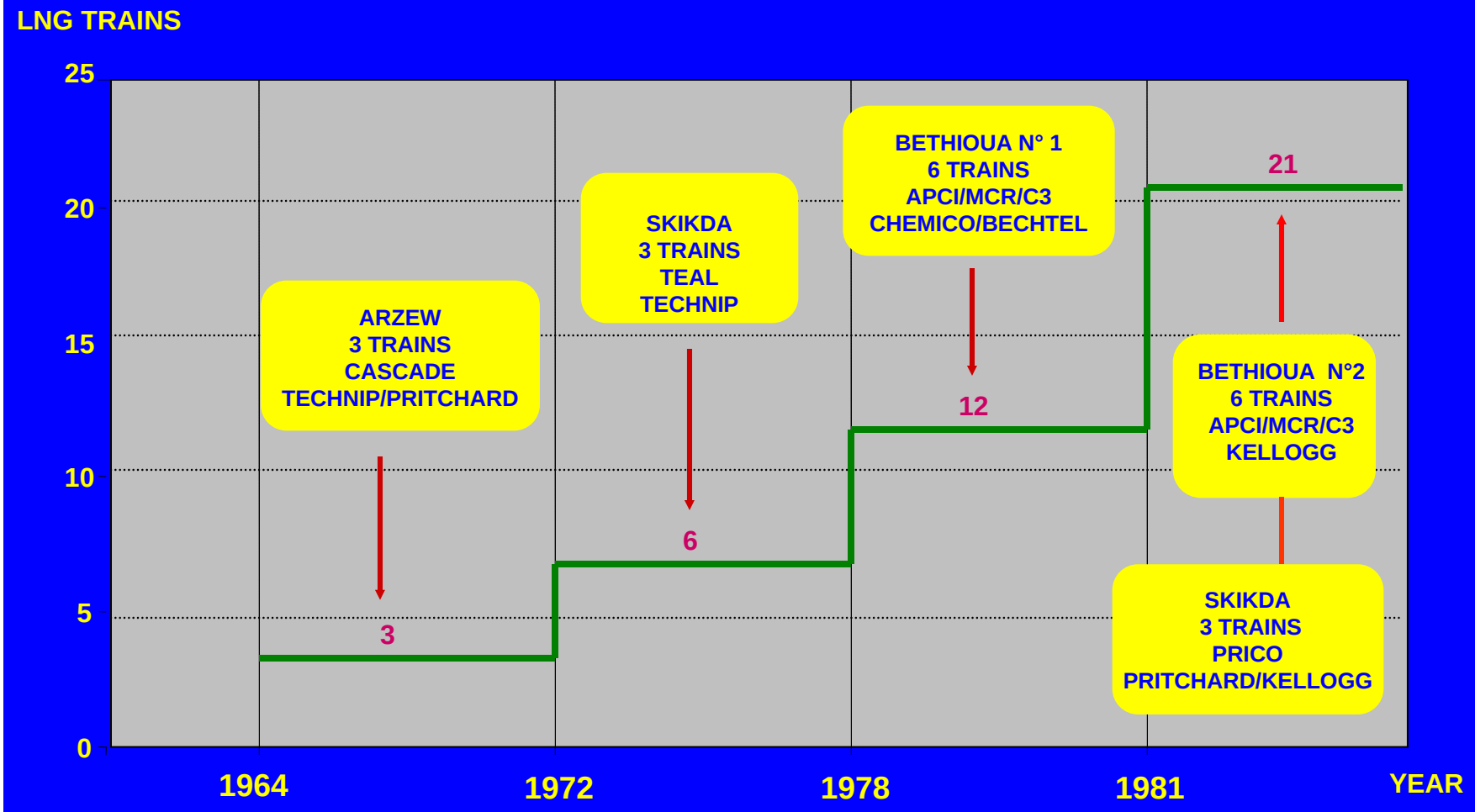
ALGERIAN LNG INDUSTRY

	WORLD-WIDE	ALGERIA	(%)
➔ LNG PLANTS:	17	4	24
➔ LNG TRAINS:	73	21	29
➔ LIQUEFACTION CAPACITY (MMTPA):	141	23	16

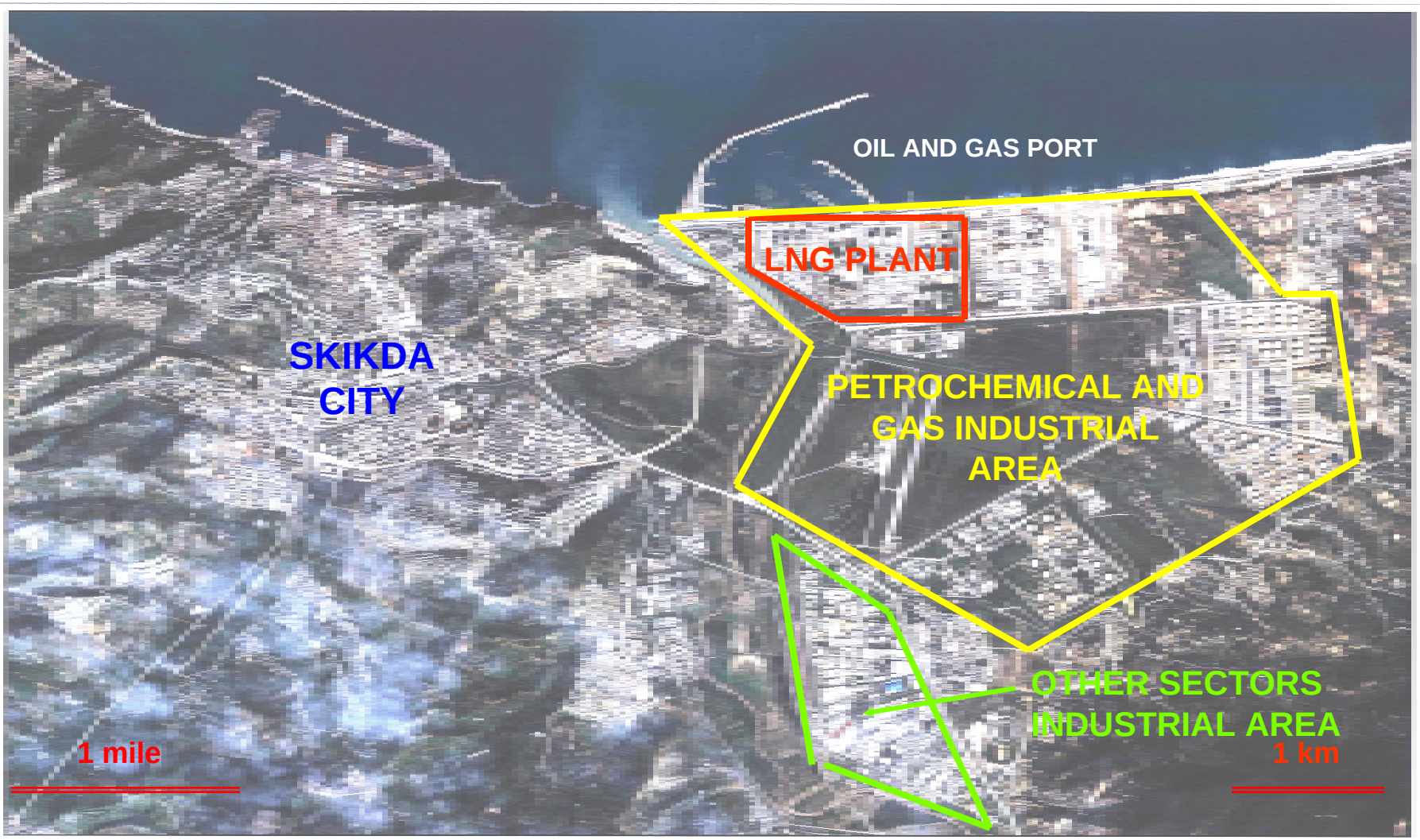


ALGERIAN LNG INDUSTRY

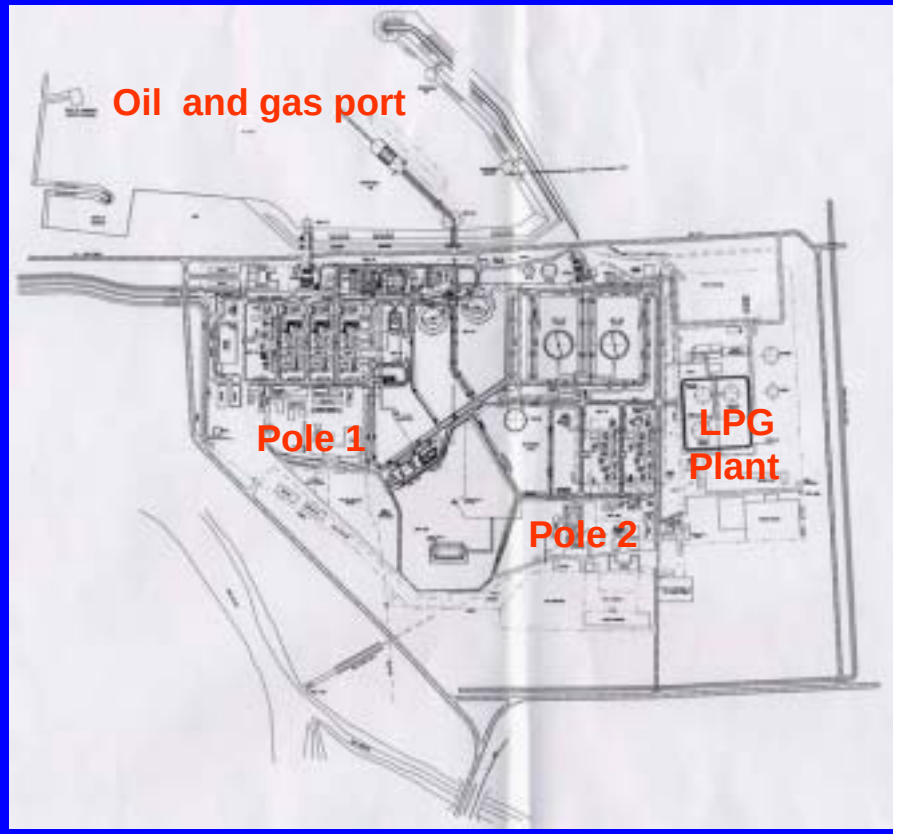
HISTORICAL LNG PLANT START UP OPERATION IN ALGERIA



SKIKDA LNG PLANT

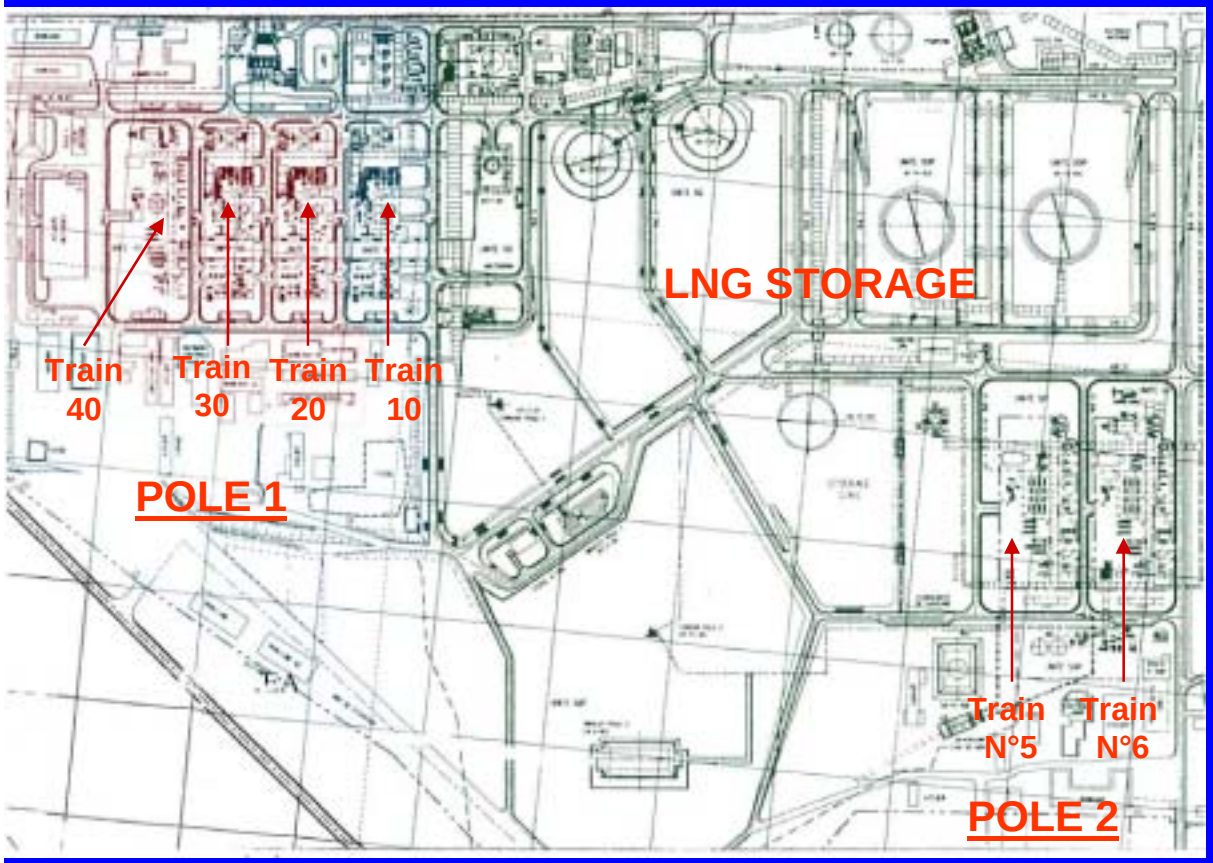


SKIKDA LNG PLANT



LOCATION :	**SKIKDA**
TRAINS NUMBER :	**6**
INSTALLED CAPACITY :	**6 MMTPA**
LNG STORAGE CAPACITY :	**308 000 m^3**

SKIKDA LNG PLANT



POLE 1

Trains 10/20/30

Train capacity : 1 MMTPA
Process : TEAL/MCR
Start-up date : 1972

Train 40

Train capacity : 0,9 MMTPA
Process : PRICO/MCR
Start-up date : 1981

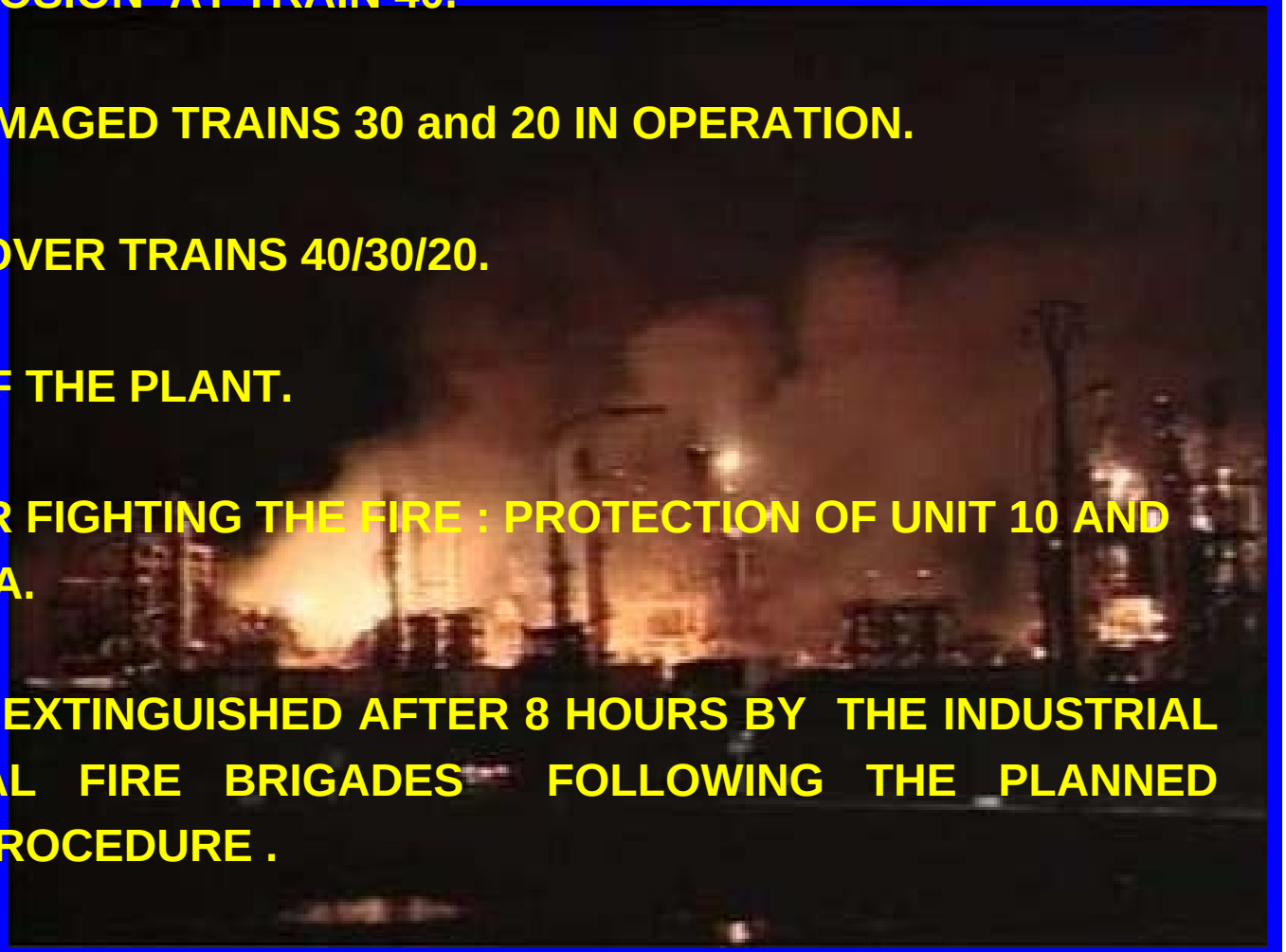
POLE 2

5° et 6° Trains :

Train capacity : 1,1 MMTPA
Process : PRICO/MCR
Start-up date : 1981

THE 19 JANUARY 2004 INCIDENT

- 6. 40 PM : EXPLOSION AT TRAIN 40.
- THE BLAST DAMAGED TRAINS 30 and 20 IN OPERATION.
- LARGE FIRE COVER TRAINS 40/30/20.
- SHUT DOWN OF THE PLANT.
- STRATEGY FOR FIGHTING THE FIRE : PROTECTION OF UNIT 10 AND STORAGE AREA.
- THE FIRE WAS EXTINGUISHED AFTER 8 HOURS BY THE INDUSTRIAL AND REGIONAL FIRE BRIGADES FOLLOWING THE PLANNED EMERGENCY PROCEDURE .



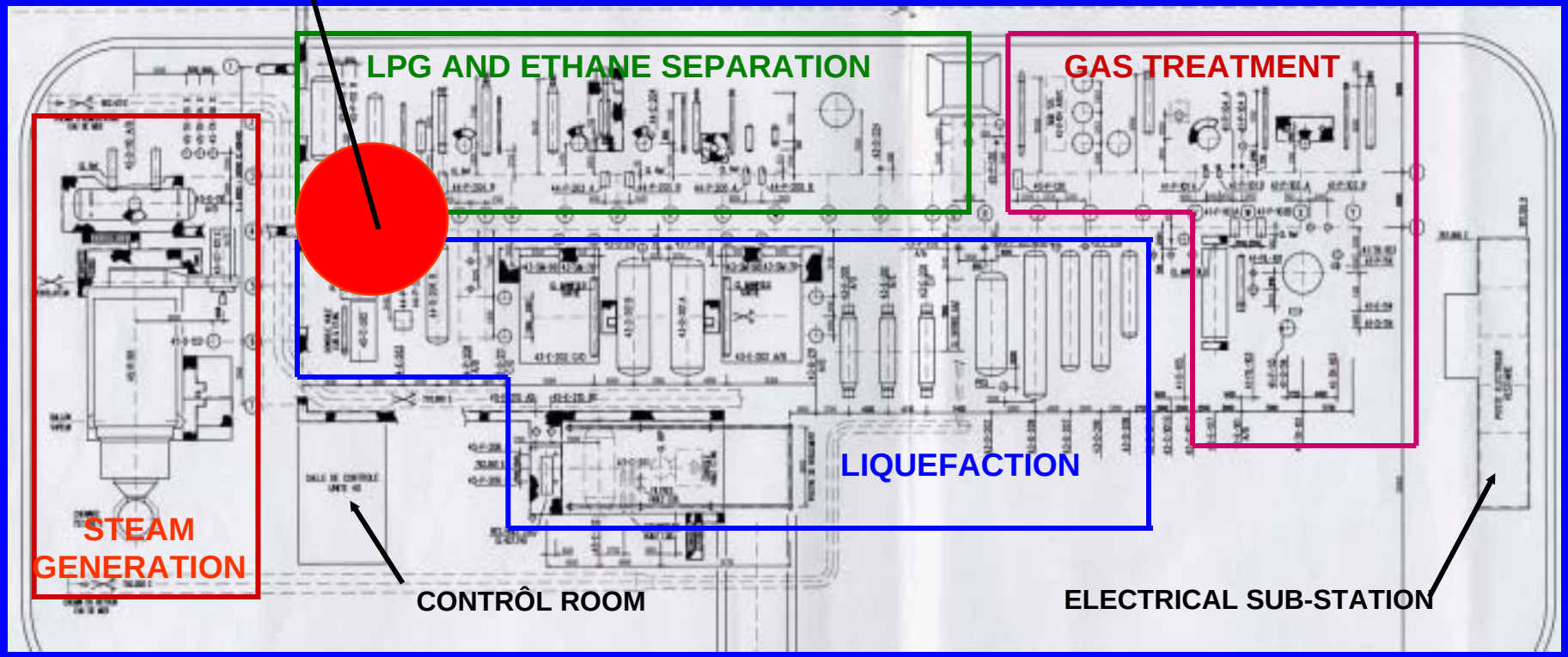
THE 19 JANUARY 2004 INCIDENT

TRAINS ON FIRE

THE 19 JANUARY 2004 INCIDENT

TRAIN 40

FOUR MAIN SECTIONS : STEAM GENERATION
GAS TREATMENT
GAS LIQUEFACTION
LPG, ETHANE AND GASOLINE SEPARATION



THE 19 JANUARY 2004 INCIDENT

EVENTS REPORTED BY OPERATORS

1. At approximately 6.39 PM an operator at unit 40 control room noticed the steam pressure in the boiler drum mounting rapidly to the point where the safety valve operated.

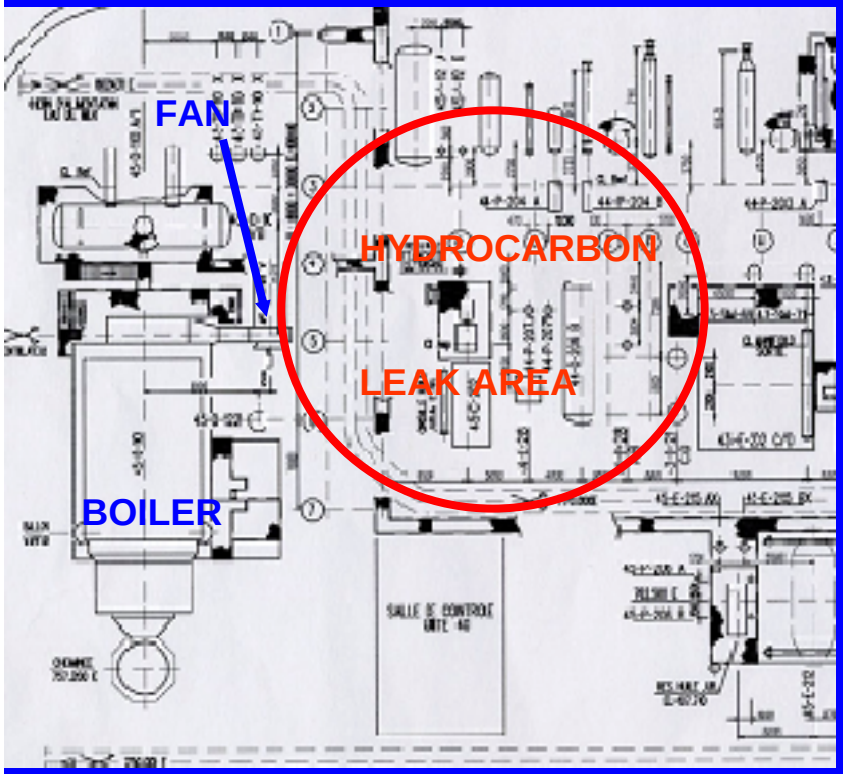
2. The operator reduced the fuel gas flow to the burners to minimum setting although this did not stop the pressure valve.

3. At 6.40 PM an operator near the train 30 start to report to train 40 control room by using intercom that a vapour cloud was developing on unit 40 and at the same time a first explosion was heard followed immediately by a second more massive explosion and a huge fireball.

4. The ensuing fire rapidly engulfed train 40, 30 and 20 due to damages incurred by the blast to piping and equipments on these trains in operation at this moment.

THE 19 JANUARY 2004 INCIDENT

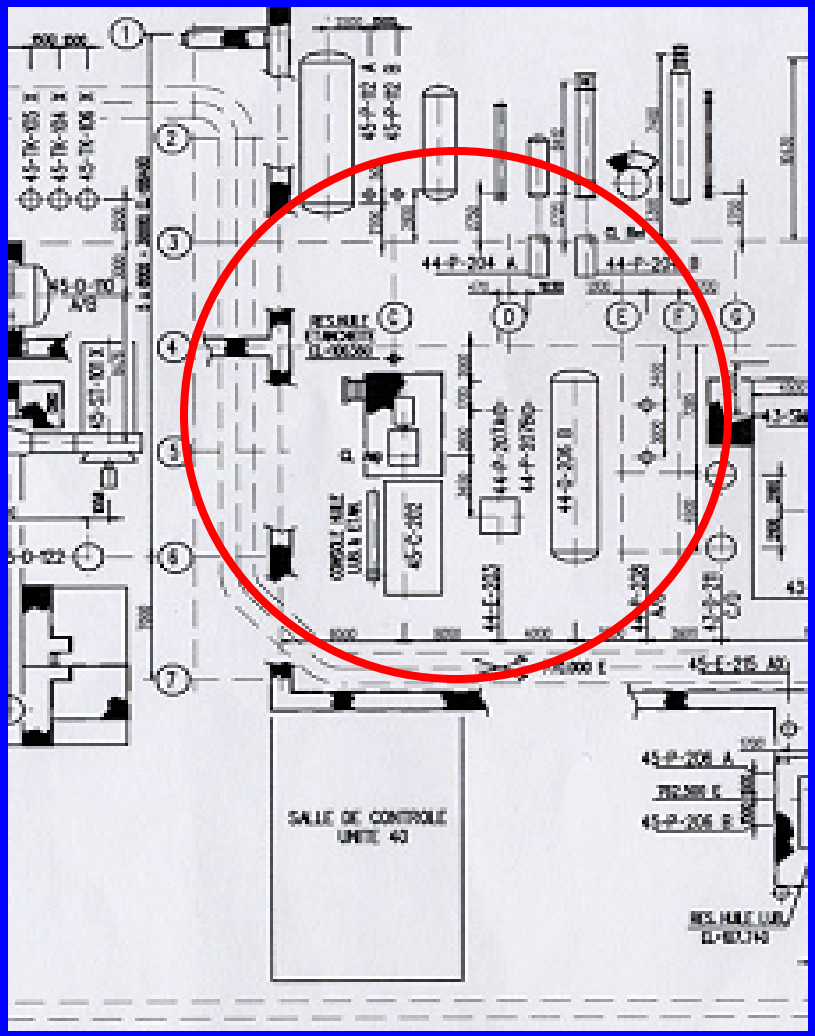
ON THE EVENTS REPORTED BY OPERATORS AND DAMAGES TO THE PLANT THE INCIDENT PROBABLY OCCURED AS FOLLOWS :



1. Important cold hydrocarbon leak near the boiler.
2. Hydrocarbon and air mixture introduction by the fan to the boiler.
3. Rapid steam pressure mounting in the boiler drum due to large gas quantity burning inside of the boiler.
4. The non controlled gas entrance inside the boiler developed an explosive mixture inside the boiler fire box.
5. Explosion inside the boiler destroying the boiler water wall and igniting the vapour cloud present outside the boiler.
6. Explosion of the vapour cloud that was unfortunately at the right explosion ratio.

THE 19 JANUARY 2004 INCIDENT

FLUIDS AND EQUIPMENTS IN THE EXPLOSION AREA

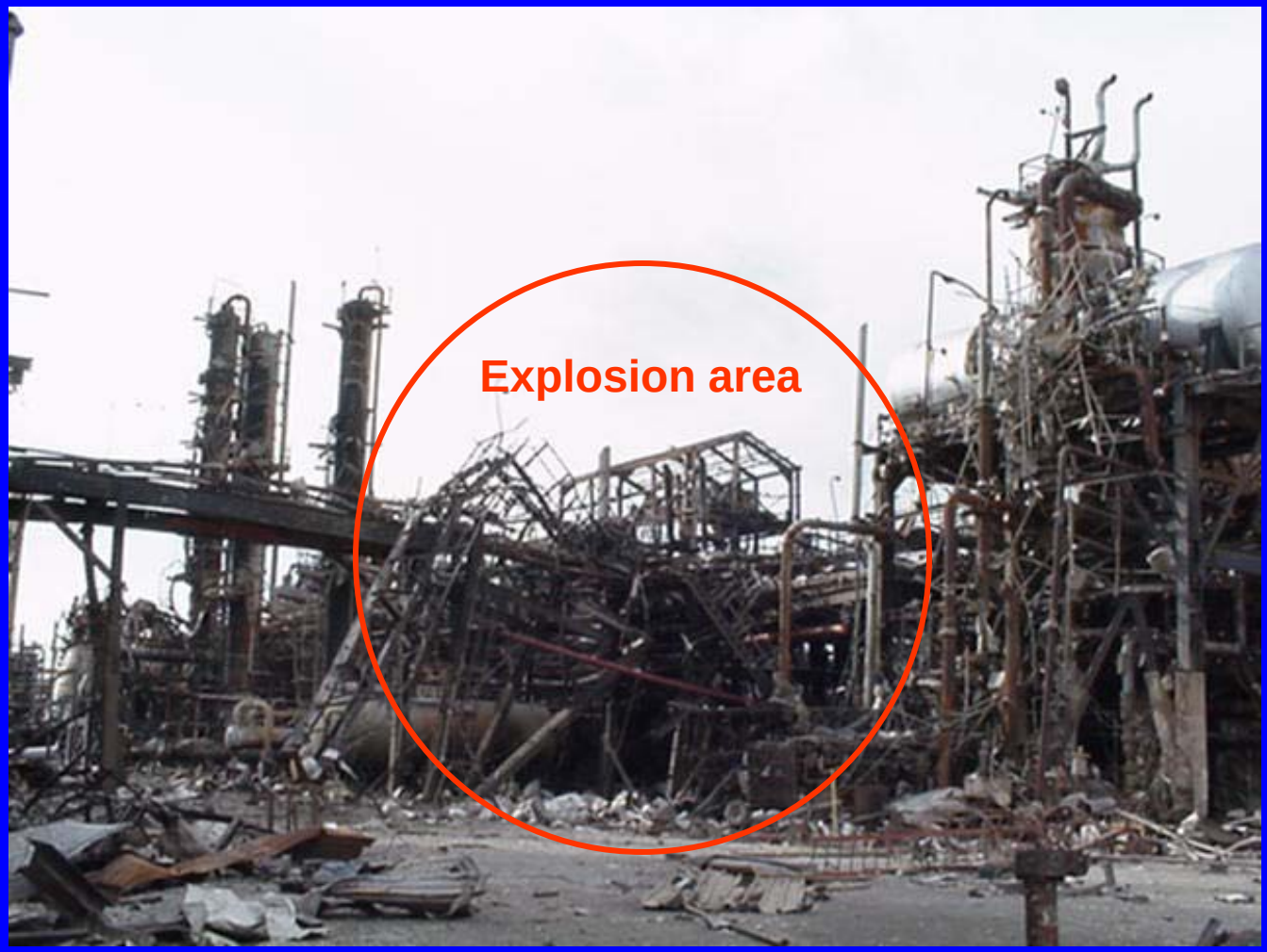


- **COLD FLUIDS**
  - LPG : T = - 4 0 ° C
  - HP FLASH GAS : (47 % INERT GAS 53 % CH_4)
    T = - 148 ° C
  - BP FLASH GAS : (29% INERT GAS 71 % CH_4)
    T = - 6 ° C
  - LNG : T = - 161 ° C

- **EQUIPMENTS**
  - FUEL GAS EXCHANGER
  - FUEL GAS COMPRESSOR
  - FUEL GAS FLASH DRUM
  - LNG PUMPS

- **PIPING**
  (TRANSPORTING COLD FLUIDS IN GAS AND LIQUID FORM)

THE 19 JANUARY 2004 INCIDENT



TRAIN 40 AFTER 19 JANUARY 2004

THE 19 JANUARY 2004 INCIDENT

PRELIMINARY CONCLUSION

- Explosion due to large and sudden cold hydrocarbon leak in gas or liquid form.
- Unfortunately this leak was transformed into a large explosion and blast by :
  - Boiler fan location near the leak.
  - Presence of an ignition source (Explosion and flame in the boiler).
  - Weather condition (no wind).
  - Semi-confined area where the leak occurred.EMI-CONFINED

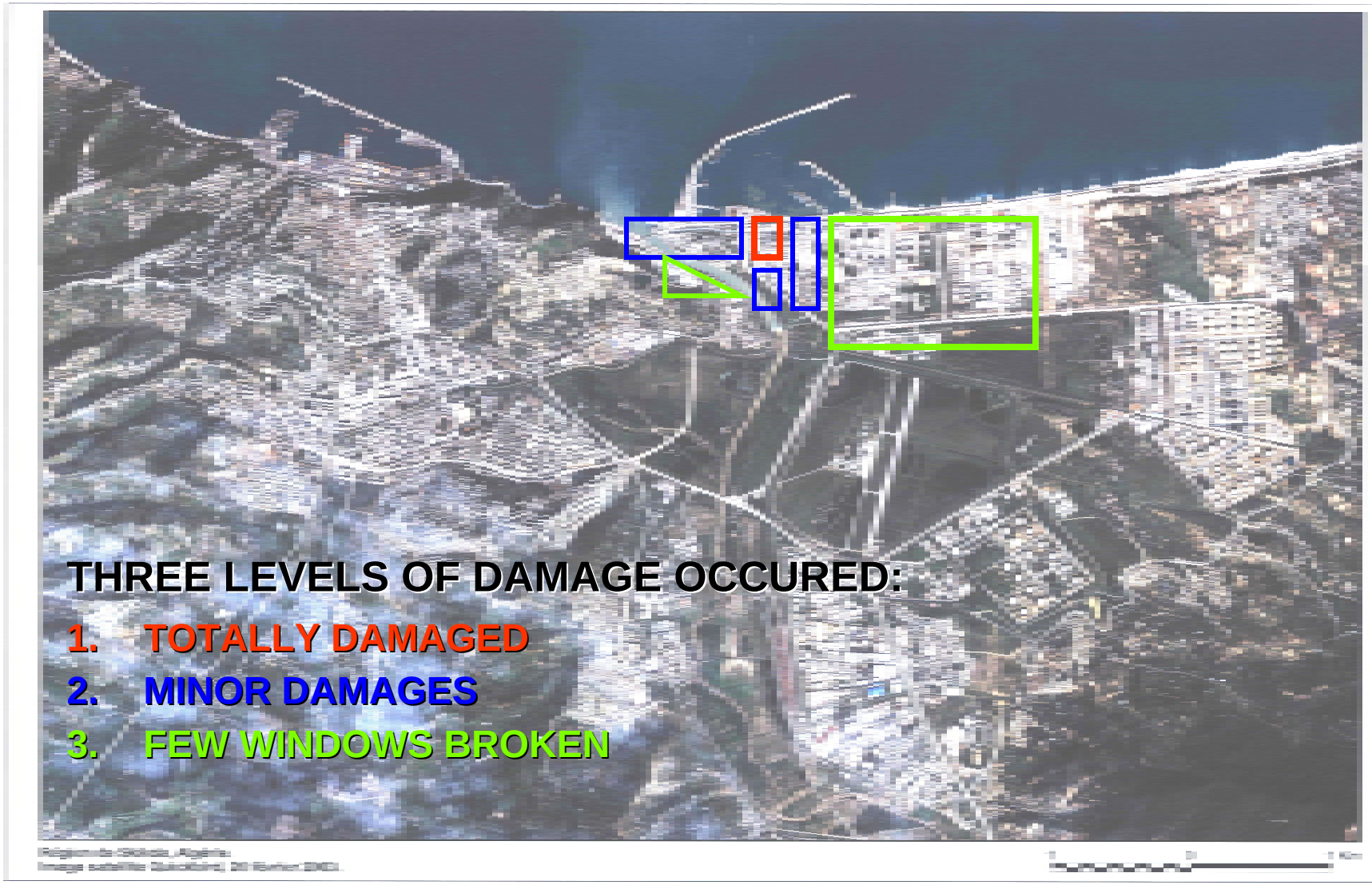
    (Presence on 3 sides : control room- cold boxes- boiler)
- Difficulty to find at this stage which fluid leaks and from which equipment or pipe due to the damage level in the train 40 explosion area.
- Investigation by experts still going on to find which fluid leaked and from what.

HUMANS CASUALTIES

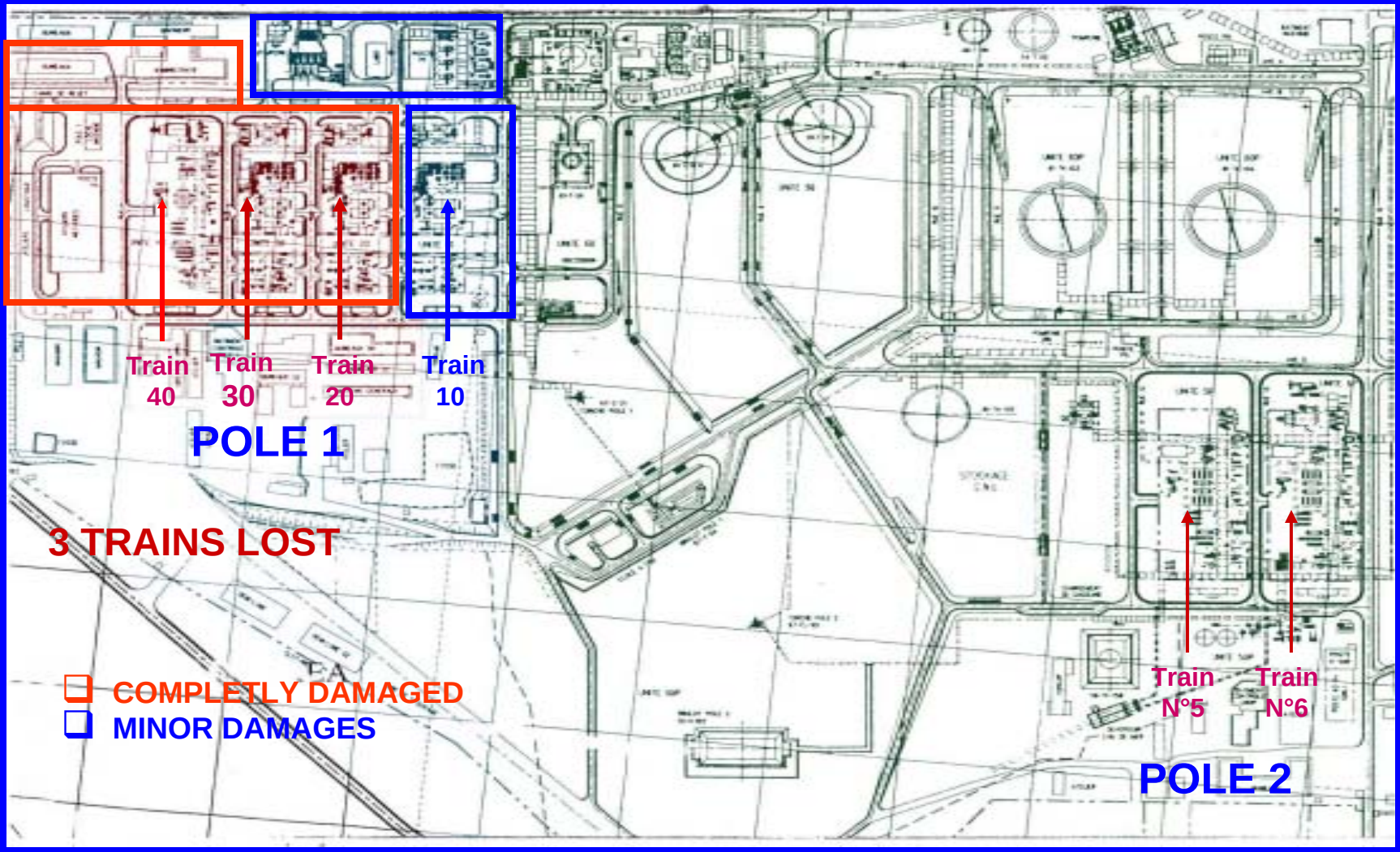
- Casualties limited to LNG plant personnel :
  - Personnel died : 27
    - –Operators : 10
    - – Maintenance : 08
    - – Safety : 07
    - – Guards : 02
  - Personnel wounded : 56

    (The majority leaft the hospital the same day only five were seriously wounded).
- The casualties are dues mainly to the blast :
  - Employees thrown or wounded by projectile or glass.
  - Employees trapped inside collapsed buildings (maintenance and security).
  - Few casualties by fire.

DAMAGES NOTICED



OCCURED DAMAGES IN LNG PLANT



OCCURED DAMAGES IN LNG PLANT

POLE 1 LNG PLANT BEFORE 19 JANUARY 2004

POLE 1 LNG PLANT AFTER 19 JANUARY 2004

OCCURED DAMAGES IN LNG PLANT

OCCURED DAMAGES IN LNG PLANT

TRAIN 40 AND PART OF TRAIN 30

OCCURED DAMAGES IN LNG PLANT

TRAIN 40 AND PART OF TRAIN 30

OCCURED DAMAGES IN LNG PLANT

COLLAPSED MAINTENANCE BUILDING NEAR TRAIN 40

OCCURED DAMAGES IN LNG PLANT

TRAIN 10 AND UTILITIES

TRAIN 10 AFTER 19 JANUARY 2004
MINOR DAMAGES

BOILER TRAIN 10 AFTER 19 JANUARY 2004
MINOR DAMAGES

TRAIN N°5

TRAIN 5 AFTER 19 JANUARY 2004
NO DAMAGES

LNG STORAGE AND LOADING FACILITIES

LOADING FACILITIES AFTER 19 JANUARY 2004
NO DAMAGES

LNG STORAGE AFTER 19 JANUARY 2004
NO DAMAGES

ACTIONS TAKEN BY SONATRACH

- **IMMEDIATELY**
  - Make safe the three damaged trains (40/30/20/10).
  - Social actions for the victims family.
  - Investigation on the incident and evaluation of the damages with insurers.
  - Inspection and return in operation of the loading and storage.
  - Temporary installation of the maintenance and others services.
  - Temporary telecommunication and lay out of a new intranet.
  - Acquisition of a new means (Transport, computer, reproduction).
- **IN COURSE**
  - Inspection and minor reparation on train N°5 and N°6.
  - Train N°5 start up (Planned : May 2004).
  - Train N°6 start up (Planned : June 2004).
  - Detailed inspection and reparation on train N°10 and Pole N°1 utilities.
  - Isolation of train N°10 and utilities from trains N°40, N°30, and N°20.
  - Train N°10 start up (Planned : October 2004).
- **PLANNED**
  - Dismantling of the trains 40-30-20.
  - New train construction to replace the destroyed three trains.

SKIKDA LNG CAPACITY AFTER THE INCIDENT

- Number of trains : 3
- Total capacity : 3,2 MMTPA
- LNG storage capacity : 308 000 m^3

- <u>Train 10:</u>
  - Train capacity : 1 MMTPA
  - Process : TEAL/MCR
  - Start-up date: 1972

- <u>Train N° 5 AND N°6 :</u>
  - Train capacity : 1,1 MMTPA
  - Process : PRICO/MCR
  - Start-up date: 1981

ALGERIAN LNG CAPACITY AFTER THE INCIDENT

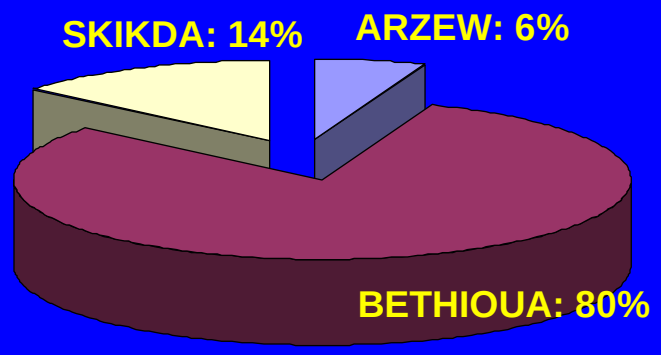
Arzew Industrial Area

Skikda Industrial Area

- LIQUEFACTION CAPACITY: 20.2 MMTPA

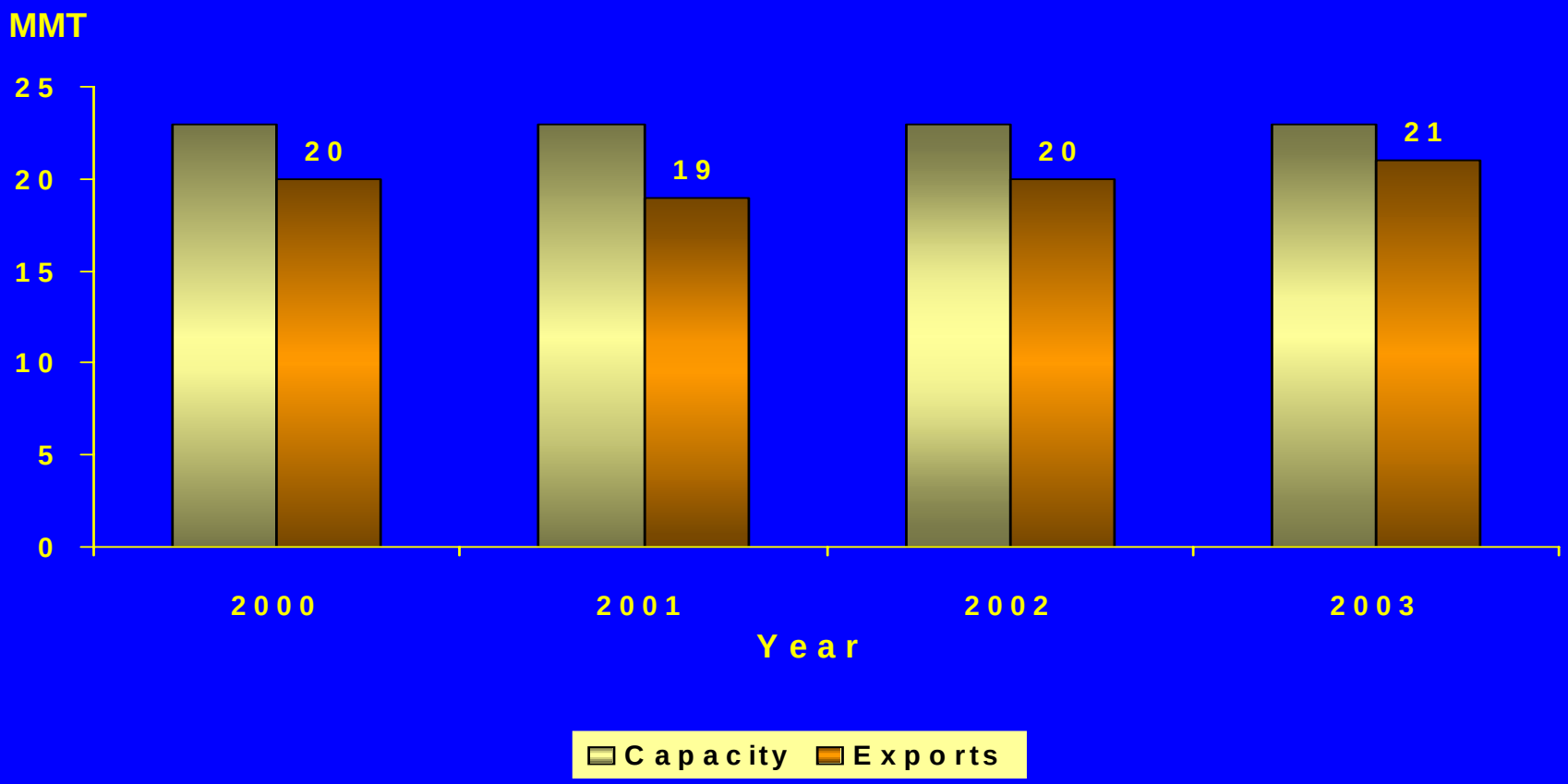
  WITHIN 80 % AT BETHIOUA.

- 4 LNG PLANTS : 18 TRAINS.
  - 1 LNG PLANT (3 TRAINS) AT ARZEW
  - 2 LNG PLANTS (12 TRAINS) AT BETHIOUA
  - 1 LNG PLANT (3 TRAINS) AT SKIKDA



ALGERIAN LNG MARKETING

LNG EXPORTS VERSUS LIQUEFACTION CAPACITY (2000-2003)

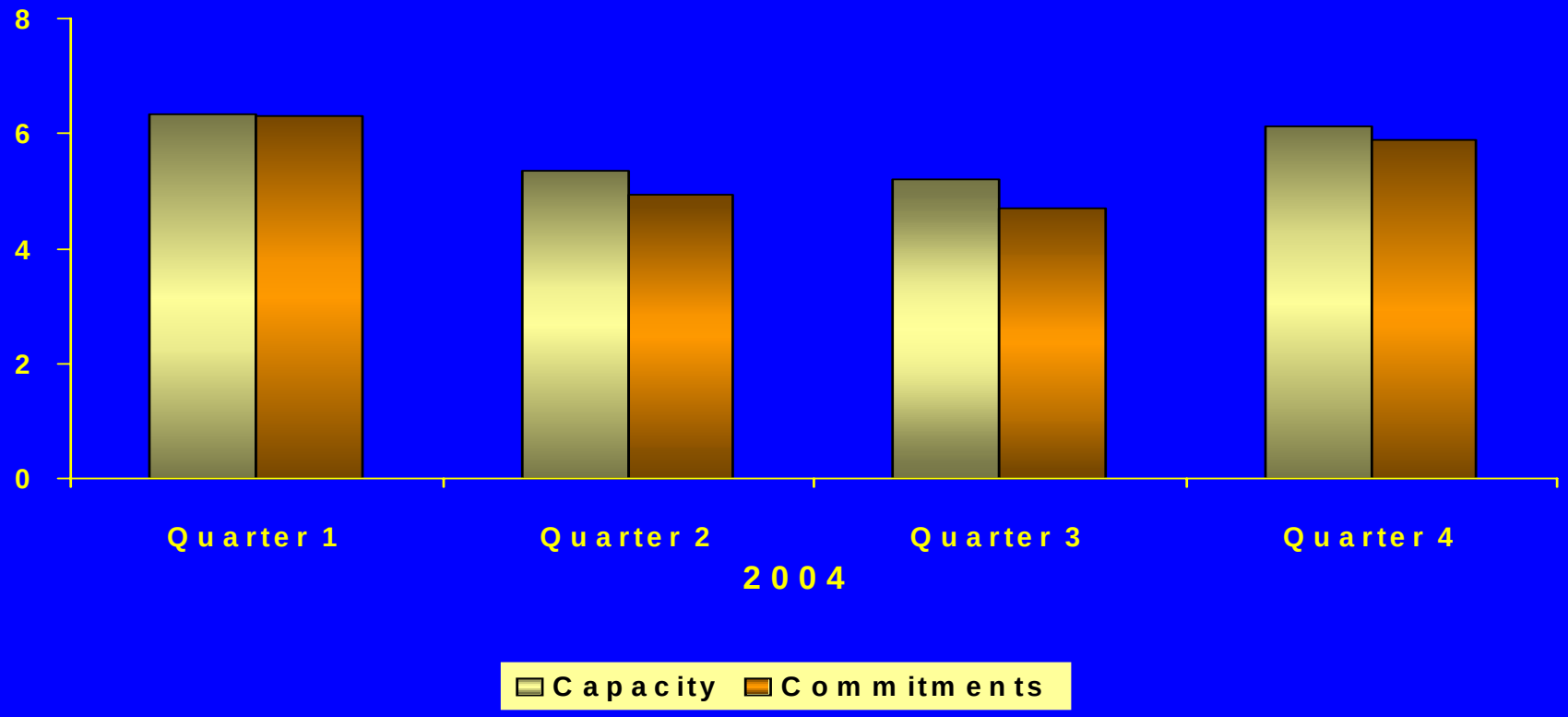


Annual capacity : **23 Million Tons**

ALGERIAN LNG MARKETING

CONTRACTUAL COMMITMENTS VERSUS PRODUCTION CAPACITY - YEAR 2004-

(BEFORE 19 JANUARY 2004)



Contractual commitments : **22 Million Tons**

ALGERIAN LNG MARKETING

LNG PRODUCTION DEFICIT - YEAR 2004 -

(AFTER 19 JANUARY 2004)

Period 1

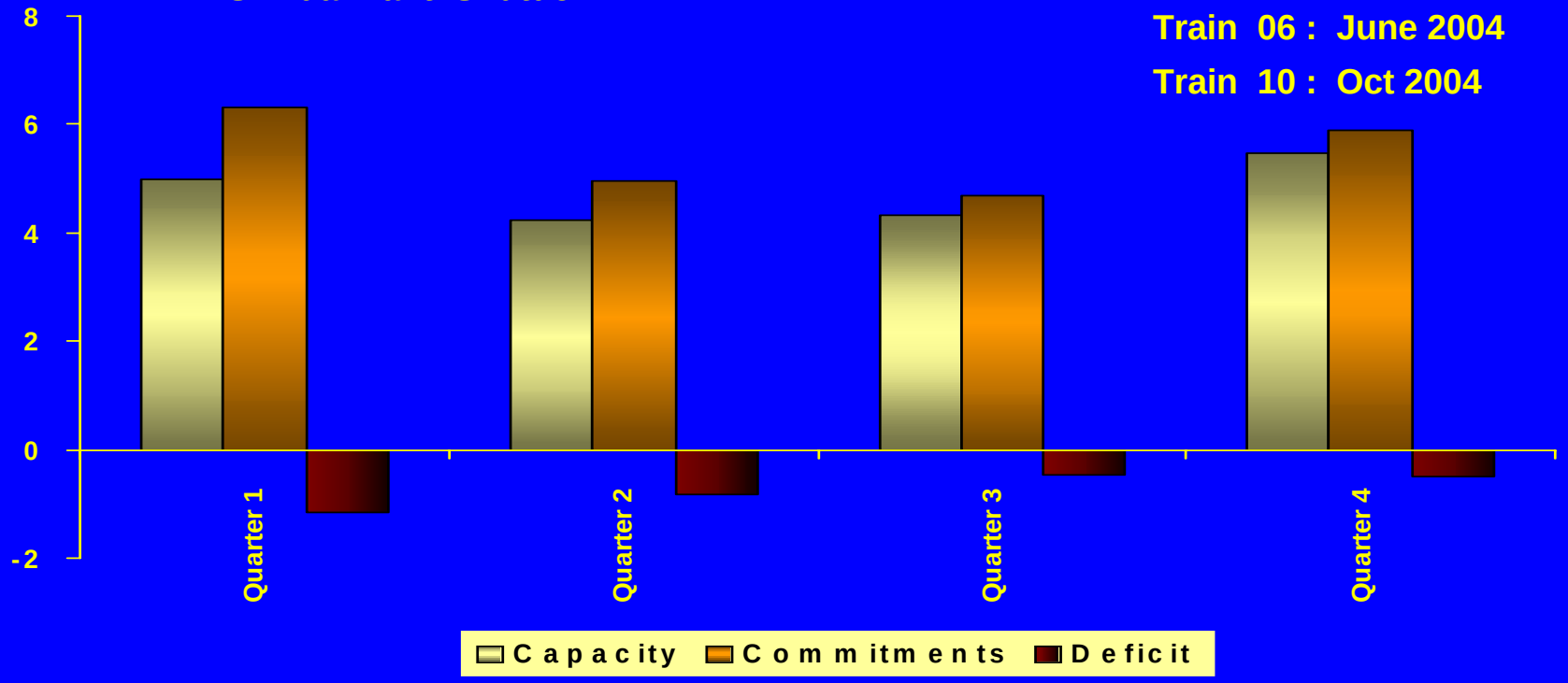
Skikda Plant Shutdown

Period 2

Skikda Start up : Train 05 : May 2004

Train 06 : June 2004

Train 10 : Oct 2004



YEAR 2004 (Million Tons)

Capacity : 19 **Commitments : 22** **Deficit : 3**

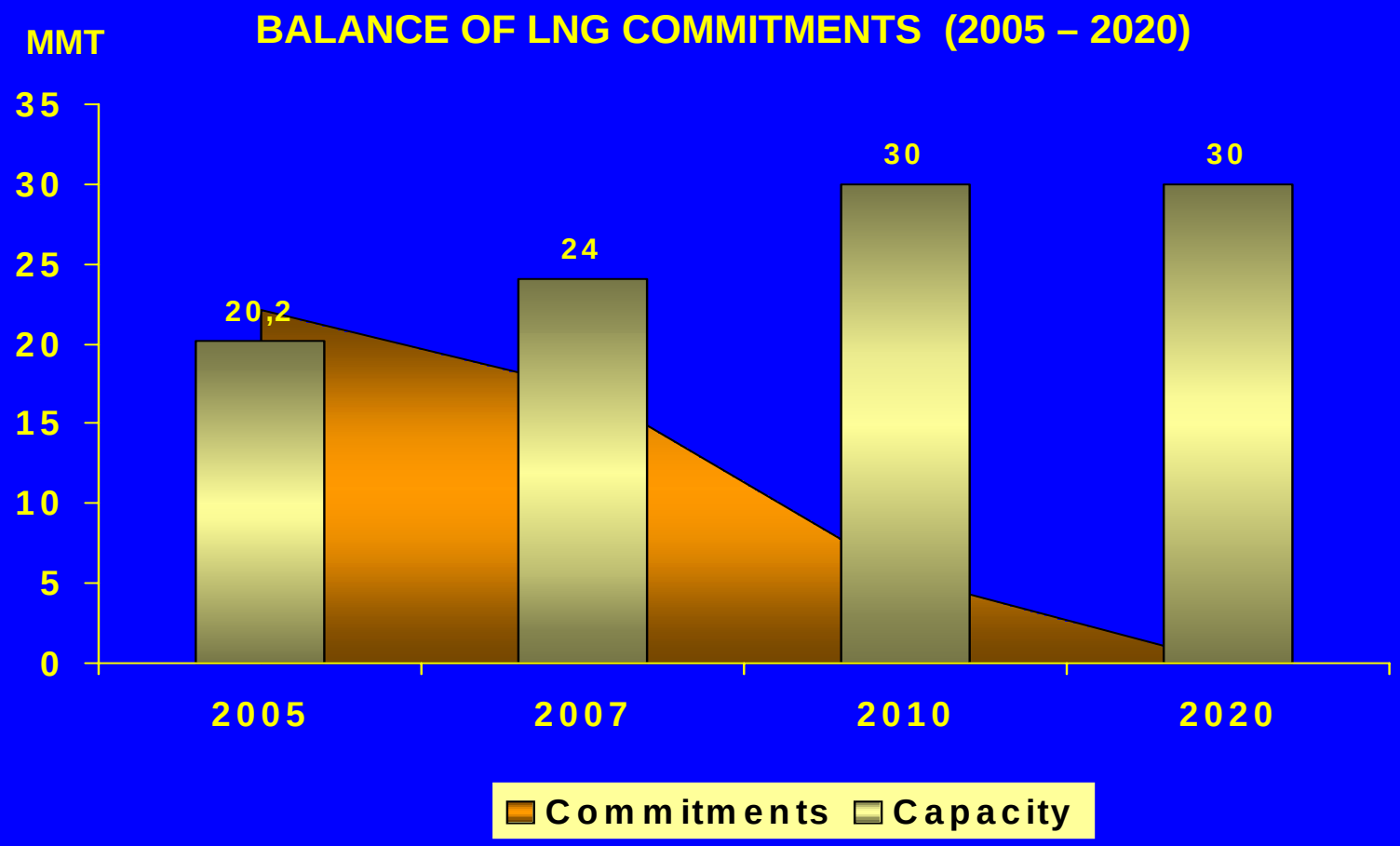
ALGERIAN LNG MARKETING

HOW TO MAKE UP THE DIFFERENCE ?

- **Through LNG**
  - **Optimisation of production capacity of Camel and Béthioua 1& 2.**
  - **LNG supply from alternative sources.**

- **Through Pipeline Gas**
  - **Availability of additional capacity on Maghreb – Europe Pipeline (Compression Station start-up).**
  - **The use of Transmediteranean Pipeline flexibility.**
  - **Sourcing from other producers.**

ALGERIAN LNG MARKETING



- New train in Skikda : 4 Millions Tons
- Integrated Project (Gassi Touil + other fields) capacity : 6 - 8 Millions Tons

THANK YOU

FOR

YOUR KIND ATTENTION